

October 18, 2001



Fermilab

*BEAMS DIVISION/CRYOGENIC SYSTEMS
ENGINEERING and DESIGN GROUP*

Minutes from Wednesday, Oct 12th Muon Collider/Cryogenics Meeting

Place: Outfield Conference Room, MW9

Attendees: Milorad Popovic, Dan Kaplan, Alex Martinez, Barry Norris, Christine Darve, Arkadiy Klebaner, Bill Luebke, Mary Anne Cummings, Ed Black

Minutes Prepared by: Barry Norris

The minutes below are given in a sequential order. The meeting lasted from 11am to 12:30pm.

- B Luebke was introduced as an available technician to the project by Dan Kaplan
- We looked at previous meeting notes. Decided +/- 2.5% is the proper hydrogen density change to be allowed, and not the +/- 5% recorded.
- Heat load.....Dan Kaplan explained the need to understand the Total Ionization Rate that the Linac can produce. Carol Johnstone to be involved in this analysis.
- Dan is worried about the "narrowness" of heat load at 20 Kelvin. Wants cryo to be flexible enough to handle increased heat load numbers.
- Arkadiy spoke of Tevatron refrigerator test to be done soon...will give us a handle on whether we can operate this refrigerator system at 20K stably. Max capacity exp will also be tried.
- Issue of Lab G dewar fill style discussed. Alex M. spoke of this method. Cryo takes a stance that the solution is more expensive in the long-term. We would rather have a fully automated cryo system to limit the manpower we need to provide.

- Arkadiy fully explained the physical refrigerator configuration possible to support the 20K and 5K options.
- The question was asked: Has anyone used 5K helium on a hydrogen heat exchanger system? Del spoke of doing it on a small volume of hydrogen (0.44 liters) and this included the use of heaters on a condensing plate. There was discussion about using a very high thermal conductivity material to prevent H₂ freeze.
- Dan spoke about others who are analyzing the use of helium latent heat techniques. Cryo Dept. would like to understand what is being studied.
- Dan again speaks about possibility of supporting 1500 watts at 20K.
- Ed Black introduced a proposed layout showing the absorber, heat exchanger, and hydrogen gas reservoir. Lengthy discussion concerning the system diagram.

This discussion needs to continue to understand the overall concept of recovering hydrogen in a pressurized tank.

- Del mentioned that the traditional use of the tank came about in deuterium usage due to the expense of deuterium.
- Discussion of 52x volume: Del says this was looking at a flask (thin container)...what would happen if liquid hit vacuum space....vacuum is sized so that it remains at the vapor side of the operating point
- Norris asked is hydrogen would be allowed to be vented...Del answered yes. Norris asked if tank was needed at all....it was thought that we don't absolutely need it.
- Discussion of secondary containment: "In cases where vessel/vacuum standard it is not clear that a secondary containment is needed." – Del
- Del spoke briefly about the need to use NEC standards in hydrogen area. Must use hazard sensing and venting mechanisms wherever we have hydrogen.
- Del emphasized the need to limit the volume of hydrogen. If the absorber is 9 liters we need to concentrate on limiting any volume above that.
- Christine states that pump we have is permitted a maximum H₂ flow of 550 g/s
- Arkadiy showed a delta Temp for 5% density change at 0 pressure drop at various operating pressures....***We need to understand this systems pressure drop in a very hard way...this becomes a fundamental to our design.***

- Arkadiy on record per his request.....the lower the deltaP the more margin we will have in MAWP and maximum operating pressure.
- Del comments on LH2 standard: MAWP = 25 psid with relief valve sitting at 10 psig....vacuum insulated.
- Del again spoke of rupture on windows....25 psid X 4 > 100 MAWP across each window before it breaks.....
- Christine asks do both elastic and plastic modes have to be simulated for window performance...Dan talks that this has shown the plastic region must be simulated ***(It is not clear to Barry what the answer to Christine's question was!)***
- Arkadiy points out the need to look at Secondary Stresses on cooldown. Dan states there will be a LN2 cooldown test.
- Del was asked to go to Northern and look at the tests. Del said he could do that.
- Christine asks Ed to look at the design for 550 g/s flow. What is the delta P through the absorber?
- Christine showed a correlation between the H2 density change and the deltaT in the absorber operating at T = 17K. For a 5% density change, we can foresee a deltaT of 4K. For a deltaT of 1K we can foresee a density change lower than 1.5%.

THE END